MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

VOL. XXV. APRIL, 1897. No. 4

INTRODUCTION.

The MONTHLY WEATHER REVIEW for April, 1897, is based on 2,927 reports from stations occupied by regular and voluntary observers, classified as follows: 143 from Weather Bureau stations; numerous special river stations; 33 from post surgeons, received through the Surgeon General, U. S. Army; 2,588 from voluntary observers; 96 received through the Southern Pacific Railway Company; 14 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 32 from Canadian stations; 1 from Hawaii; 20 from Mexican stations. International simultaneous observations are received from a few stations and used together with trustworthy newspaper extracts and special reports.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe. Unless otherwise specifically noted, the text is written by the Editor, but the meteorological tables contained in the last section are furnished by Mr. A. J. Henry, Chief of the Division of Records and Meteorological Data. Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada, Mr. Curtis J. Lyons, Meteorologist to the Government Survey, Honolulu, and Dr. Mariano Bárcena, Director of the Central Meteorological Observatory of Mexico.

CLIMATOLOGY OF THE MONTH.

GENERAL CHARACTERISTICS.

The month was remarkable for the continued excess of rainfall in the Valley of the Mississippi and its tributaries, and for the consequent steady increase of dangerous floods in these rivers, a full account of which is given in the chapter on Rivers and Floods. A remarkable rise in barometric pressure occurred in Washington and Oregon, characteristic of the establishment of the summer season but at a much earlier date than usual. The temperature was above normal over the Lake Region and New England, and over Alberta, Saskatchewan, and Manitoba in Canada; the accumulated departures from normal temperature show that the Mississippi Valley and Lake Region already have a surplus of heat that will produce a continued warm soil and rapid vegetation during the summer unless abnormal conditions intervene.

ATMOSPHERIC PRESSURE.

[In inches and hundredths.]

The distribution of mean atmospheric pressure reduced to sea level, as shown by mercurial barometers, not reduced to standard gravity, and as determined from observations taken daily at 8 a. m. and 8 p. m. (seventy-fifth meridian time), is shown by isobars on Chart IV. That portion of the reduction to standard gravity that depends on latitude is shown by the numbers printed on the right-hand border.

The *mean pressure* during the current month was highest on the coast of Washington and Oregon, and almost as high on the coasts of North and South Carolina. It was lowest in Arizona and almost as low in Saskatchewan. The highest reduced pressures were: In the United States, Tatoosh Island, 30.18; Eureka, 30.17; Seattle, Hatteras, Charleston, 30.16; Lynchburg, Raleigh, Wilmington, and Fort Canby, 30.15. In Canada, White River, 30.10; Calgary, 30.05; Port Arthur, 30.04; Bermuda, 30.16. The lowest were: In the United States, Phœnix, 29.87; Yuma, 29.88; El Paso, 29.94; Havre, 29.97. In Canada, Prince Albert, 29.89; St. Johns, 29.94; Battleford and Medicine Hat, 29.98.

As compared with the normal for April, the mean pressure was generally in excess throughout the United States and Canada. The greatest excesses were: In the United States, Tatoosh Island, Erie, and Hatteras, 0.16; Block Island, Atlantic City, Lynchburg, and Norfolk, 0.15; Kittyhawk, Raleigh, and Wilmington, 0.14. In Canada, Halifax, 0.16; Sydney, 0.14; Calgary, 0.13. The deficits were: In the United States, Yuma, 0.03. In Canada, Swift Current, 0.01; Winnipeg, 0.03.

As compared with the preceding month of March, the pressures reduced to sea level show a rise throughout the United States, except in Florida and Arizona, but a fall over the northern Slope and Canadian Northwest Provinces. The greatest rises were: In the United States, Tatoosh Island, 0.31; Fort Canby, 0.27; Seattle, 0.26; Portland, Oreg., 0.20. In Canada, Esquimault, 0.29; St. Johns, 0.17. The greatest falls were: In the United States, Winnemucca, 0.11; Havre, 0.10; Miles City, 0.09; Moorhead, 0.08; Bismarck, Yuma, and Phœnix, 0.07. In Canada, Prince Albert, 0.20; Battleford, 0.14; Swift Current, 0.13.

AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. HAZEN.

During the month of April eleven high areas and seven low areas were sufficiently well defined to be charted and their paths, together with the pressure near the center at 8 a. m. and 8 p. m., will be found in Charts I and II. The accompanying table gives the principal facts regarding the place of origin and disappearance of each high and low, and also the duration and length of each path with the velocity. A rather permanent area of high pressure in the Pacific Ocean caused six of the highs of the month. Two began in the region to the north of Montana, one in North Dakota,

and two near Lake Superior. Only six of the highs reached the Atlantic, one was last noted in the central part of the Gulf of Mexico, and the rest lost their identity or were merged in other highs in the interior. The general tendency of the highs was toward a translation along the northern border of the country. The more marked characteristics of the highs were the greater number and better definition than in the past six months.

The lows were affected by the permanent high just mentioned, as none had their beginning in the Pacific. Five were first noted to the north of Montana, one in Oregon, and two in Arizona. The translation of the lows was mostly along the northern border. Five of the lows reached the north Atlantic Coast, one disappeared north of Lake Superior, and the other two in the St. Lawrence Valley.

The highest wind of the month, 68 miles per hour on the 18th, at Chicago, was in connection with storm V, when it was central in north Michigan. This storm was rather remarkable in that it had a well-developed oval and very steep barometric gradients, but no rain fell till it reached the lower Lakes and then only in slight sprinkles. It was of a class of storms previously described which are quite prevalent in April and May in the Northwest, but without precipitation. The lowest pressure, but one, of the month, 29.18 inches, at Prince Albert p. m. of 21st, occurred in the center of low area VI, and this storm also had little or no precipitation in the Northwest. As low area No. VIII passed over Qu'Appelle the lowest pressure of the month, 29.12 inches, was noted there, p. m. of the 26th. The storm also had very steep gradients and a well formed oval but without precipitation till it reached the upper Mississippi Valley where there were only sprinkles.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, a. m.	50	85	4, p. m.	40	70	1,060	3.5	303	12.6
II	5, a. m.	52	112	8, a. m.	48	62	2,270	3.0	756	31.6
III	5, p. m.	37	124	11, p. m.	29	81	3,770	6.0	628	26.2
IV	9, a. m.	50	90	13, p. m.	46	59	2,180	4.5	485	20.2
V	9, p. m.	42	127	15, a. m.	36	91	2,960	5.5	539	22.5
VI	13, p. m.	49	129	19, a. m.	32	80	3,800	5.5	691	28.8
VII	18, a. m.	52	109	22, p. m.	41	68	2,630	4.5	584	24.3
VIII	20, a. m.	40	127	27, a. m.	29	88	3,670	7.0	525	21.9
IX	26, a. m.	48	99	28, a. m.	39	80	1,140	2.0	570	23.8
X	26, p. m.	48	128	30, a. m.	51	88	2,010	3.5	574	23.9
XI	28, a. m.	41	129	30, p. m.	39	99	1,720	2.5	686	28.6
Total							27,210	47.5	6,343	
Mean of 11 paths							2,474	4.3	577	24.0
Mean of 45.5 days									573	23.9
Low areas.										
I	1, p. m.	33	111	7, a. m.	48	56	3,220	5.5	587	24.4
II	5, p. m.	33	114	10, p. m.	45	61	3,650	5.0	730	30.4
III	9, p. m.	53	117	14, a. m.	48	76	2,370	4.5	630	26.6
IV	12, p. m.	54	112	18, a. m.	48	62	2,700	5.5	491	20.5
V	15, p. m.	54	109	20, a. m.	46	58	2,650	4.5	588	24.5
VI	18, p. m.	43	120	23, a. m.	49	89	2,080	4.5	462	18.8
VII	23, p. m.	54	105	28, a. m.	41	69	2,660	4.5	591	24.6
VIII	25, p. m.	51	112	*	44	77	3,450	8.5	406	16.9
Total							23,240	42.5	4,484	
Mean of 8 paths							2,905	5.3	560	23.3
Mean of 42.5 days									547	22.8

*May 4, a. m.

TEMPERATURE OF THE AIR.

[In degrees Fahrenheit.]

Both the mean temperatures and the departures from the normal are given in Table I for the regular stations of the Weather Bureau, which also gives the height of the thermometers above the ground at each station. The mean temperature is given for each station in Table II, for voluntary observers.

The *monthly mean temperatures* published in Table I, for the regular stations of the Weather Bureau, are the simple means of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II.

The *regular diurnal period* in temperature is shown by the hourly means given in Table V for 29 stations selected out of 82 that maintain continuous thermograph records.

The *distribution of the observed monthly mean* temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart IV; the lines are drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by our observers; such isotherms are controlled largely by the local topography, and should be drawn and studied in connection with a contour map.

The *highest mean temperatures* were: In the United States, Key West, 75.5; Yuma, 72.4; Jupiter, 71.5; Corpus Christi, 70.4; Tampa, 70.3. In Canada, Bermuda, 65.0; Esquimault, 46.3; Halifax, 40.3; Toronto, 42.0; Port Stanley, 41.4; Kingston and Ottawa, 40.8; Montreal, 41.1. The lowest were: In the United States, Sault Ste. Marie, 36.9; Eastport, 38.6; Marquette, 37.8; Duluth, 40.0. In Canada, Father Point, 32.8; White River, 30.1; Quebec, 35.9; Port Arthur, 35.0.

As compared with the normal for April the mean temperature for the current month was in excess slightly on the Pacific and Atlantic coasts and appreciably over the Lake Region, New England, and Nova Scotia. It was slightly deficient throughout the Mississippi watershed and its tributaries and in the Canadian Northwest Provinces.

The greatest excesses were: In the United States, Moorhead, 4.4; Boston, 3.9; Sacramento, 3.1; Baker City, 3.0; Red Bluff, 2.7; Northfield, 2.6. In Canada, Yarmouth, 4.2; Halifax, 2.9; Rockliffe, 2.8; Port Stanley, 2.2. The largest deficits were: Cheyenne, 3.1; Springfield, Ill., 2.5; Springfield, Mo., 2.2. In Canada, Swift Current, 1.1; Qu'Appelle, 0.7; Medicine Hat, 0.4.

Considered by districts the mean temperatures of the current month show departures from the normal as given in Table I. The greatest positive departures were: New England, 1.6; North Dakota and Middle Pacific, 1.8; northern Plateau, 1.5. The greatest negative departures were: Florida Peninsula and southern Slope, 1.2; east Gulf, 1.6.

In Canada.—Prof. R. F. Stupart says:

> Over the greater part of the Dominion the mean temperature was higher than the average by between 1° and 4°, but in Algoma, Nipissing, and parts of eastern Quebec it was lower than the average by from 1° to 3°. In Alberta, Saskatchewan, and Manitoba the excess was between 3° and 4°.

The years of highest and lowest mean temperatures for April are shown in Table I of the REVIEW for April, 1894. The mean temperature for the current month was the highest on record at: Sacramento, 62.6, and Boston, 49.0. It was the lowest on record at: Amarillo, 55.3.

The *maximum and minimum temperatures* of the current month are given in Table I. The highest maxima were: 100, Yuma (17th); 96, Phœnix (18th); 94, San Luis Obispo (10th), Fresno (16th); 93, Abilene (7th), Red Bluff (25th); 92, San Antonio (7th); 90, Los Angeles (10th), Roseburg (15th), Williston (26th), Moorhead (27th). The lowest maxima were: 59, Eastport (29th); 61, Nantucket (30th); 62, Block Island (30th); 65, Woods Hole (30th); 66, Sault Ste. Marie (22d), Port Angeles (25th); 68, Narragansett Pier (30), Tatoosh Island (15th). The highest minima were: 66, Key West (17th); 59, Jupiter (11th); 53, Port Eads (10th); 52, Corpus Christi (9th); 50, Galveston (9th), New Orleans